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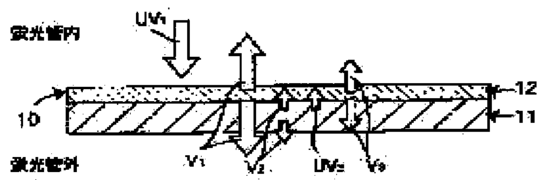
(54) FLUORESCENT LAMP AND HIGH-INTENSITY DISCHARGE LAMP

(57)Abstract:

PROBLEM TO BE SOLVED: To enhance the luminous efficiency of lamps emitting light by discharge, including a fluorescent lamp and an HID (high-intensity discharge lamp).

SOLUTION: When a phosphor layer 12 is irradiated with ultraviolet rays UV1 generated by exciting mercury and a rare gas, a phosphor is excited to generate visible light V1 (with wavelengths of about 400 nm or more). Part of the ultraviolet rays UV1 pass through the phosphor layer 12 and irradiate a glass tube 11. Since the glass tube 11 contains an excitation-emissive component, the emissive component is excited by the ultraviolet rays UV1 and thus the glass tube 11 emits near ultraviolet rays UV2 (with wavelengths more than 254 nm) and visible light V2. Part of the near ultraviolet rays UV2 emitted from the glass tube 11 irradiate the phosphor layer 12, and the phosphor in the phosphor layer 12 is excited by the near ultraviolet rays UV2 to emit visible light V3.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This inventions are a fluorescent lamp and a high intensity discharge lamp. It is related with [High intensity dischargelamp (HID)].
[0002]
[Description of the Prior Art]A fluorescent lamp and HID are widely known as a lamp which is efficient and emits light. The fluorescent lamp is provided with the arc tube with which mercury and rare gas were enclosed and the fluorescent substance was laminated on the inner surface.
By making it discharge within an arc tube, the ultraviolet rays which make a subject 254 nm by the excitation radiation of mercury are generated, and a luminescent light bunch is obtained by exciting a fluorescent substance by the ultraviolet rays, and emitting visible light.
As a type of this fluorescent lamp, although the straight pipe form from the former and an annulus are common, a bulb type, a compact form, etc. are spreading in recent years.
[0003]The high-pressure mercury lamp which emits light by discharging HID in mercury vapour of 100 - 1000kPa on the other hand, The metal halide lamp which emits light by halogenation metal's dissociating to a metal atom and a halogen atom with discharge, and carrying out excitation radiation of the visible light with a metal atom, and the high-pressure sodium lamp which emits light by discharging in sodium vapor are named generically.
[0004]
[Problem(s) to be Solved by the Invention]In such a fluorescent lamp and HID, as fundamental performance, power consumption is low, and the Takamitsu bunch is obtained, the life is also searched for for a long time, and the development for it is made. For example, in JP,11-167899,A as a thing about reinforcement of a fluorescent lamp, The point of being easy to produce the brightness lowering of a fluorescent lamp when conventional soda glass is used

and the sodium eluted from glass at the time of fluorescent lamp manufacture or lighting reacts to mercury is noted, The art of suppressing the brightness lowering of a fluorescent lamp using the glass with which alkali cannot be eluted easily rather than conventional soda glass is indicated.
[0005]In order to obtain the Takamitsu bunch with low power consumption in a fluorescent lamp, for example, the research for making luminosity of a fluorescent substance higher is made, and the development which secures discharge length is also made by small-tube-izing an arc tube. Although a fluorescent lamp and the performance of HID are also increasing with such research and development, art which makes it possible to reduce power consumption or to obtain the Takamitsu bunch in order that the request to such performances may increase further and may meet the demand is desired in recent years.
[0006]This invention was made under such a background and is ****. In the lamp which emits light by discharge including a lamp and HID, the purpose is to raise the luminous efficiency.

[0007]
[Means for Solving the Problem]In order to attain the above-mentioned purpose, when ultraviolet radiation (peak wavelength of 254 nm) according a glass tube used for a fluorescent tube to excitation of mercury was received, by this invention, we decided to form ultraviolet radiation of long wavelength rather than the ultraviolet radiation concerned with a glass material which an excited light ingredient which carries out excitation radiation contained in a fluorescent lamp. Or in a fluorescent lamp provided with a fluorescent tube with which it was covered with a protective layer to which a glass tube inner surface uses a metallic oxide as a base material, and a fluorescent substance layer was covered on the protective layer, When ultraviolet radiation by excitation of mercury was received in a protective layer, it used making an excited light ingredient which carries out excitation radiation of the ultraviolet radiation of long wavelength rather than the ultraviolet radiation concerned contain.
[0008]According to the fluorescent lamp of above-mentioned this invention, exciting ultraviolet rays with a peak wavelength of 254 nm generated with discharge in mercury vapour in a fluorescent tube, When an excited light ingredient glares, excitation radiation of ultraviolet rays and visible light of long wavelength is carried out more, and excitation radiation of-like secondary visible light is made by a fluorescent substance layer by these ultraviolet rays. Utilization efficiency with which ultraviolet rays by excitation of mercury are used for a luminescent light bunch by this operation improves. And compared with elegance, a luminescent light bunch can be raised not less than 2% conventionally in which an excited light ingredient is not contained. Here, an excited light ingredient has it, when having melted into a glass material which forms a glass tube, or a metallic oxide used as a base material of a protective layer maintains highly visible light transmittance of a glass tube or a protective layer.

[preferred]
[0009]In HID, when ultraviolet radiation by excitation radiation of photogene enclosed with an arc tube in an outer tube was received, we decided to form ultraviolet radiation of long wavelength rather than the ultraviolet radiation concerned with a glass material which an excited light ingredient which carries out excitation radiation contained. In the above-mentioned fluorescent lamp or HID, it is preferred to use an oxide of next element as an excited light ingredient which glass is made to contain.
[0010]Ti, Zr, V, Nb, Ta, Mo, W, Tl, Sn, Pb, Bi, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu this invention, It can apply also to a filament lamp and utilization efficiency with which synchrotron radiation by discharge is used for a luminescent light bunch improves by making a valve of a filament lamp contain the above-mentioned excited light ingredient.
[0011]
[Embodiment of the Invention][Embodiment 1]
[Embodiment 1] Drawing 1 is a figure showing the appearance of the compact fluorescent lamp concerning one embodiment of this invention.
[0012]The fluorescent tube 10 adheres to the cap 20, this fluorescent lamp is constituted, and the fluorescent tube 10 concerned is formed with the glass tube (glass bulb) 10 of six straight pipe shape by which the inner surface side was covered by the fluorescent substance layer 12. In this fluorescent tube 10, the six glass tubes 11 are connected so that one discharge space may be formed in an inside by carrying out bridge junction of the adjacent things at the end, and rare gas and mercury, such as argon, are enclosed in the discharge space concerned. The electrode (un-illustrating) is attached to the both ends of this discharge space in the fluorescent tube 10.
[0013]In the cap 20, the light circuit (un-illustrating) for making the fluorescent tube 10 turn on is provided. Drawing 2 is the sectional view which cut the fluorescent tube 10 into round slices. Although the glass tube 11 is formed with soda glass, during the presentation of soda glass, the ingredient (excited light ingredient) which excites by ultraviolet rays with a wavelength of 254 nm, and emits light to ultraviolet and a visible range is contained.
[0014]The oxide of the element which belongs to the oxide of the element belonging to 4A, 5A, and 6A fellows, 3B and 4B, and 5B fellows as this excited light ingredient, and the oxide of the element belonging to a lanthanoids are mentioned. As an example of the above "element belonging to 4A, 5A, and 6A fellows", titanium (Ti), zirconium (Zr), and vanadium (V), niobium (Nb), tantalum (Ta), molybdenum (Mo), and tungsten (W) are mentioned.
[0015]As an example of the above "element belonging to 3B, 4B, and 5B fellows", thallium (Tl), tin (Sn), lead (Pb), and bismuth (Bi) are mentioned. As an example of the above "element belonging to a lanthanoids", A lantern (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), Samarium (Sm), a europium (Eu), gadolinium (Gd), a terbium (Tb), dysprosium (Dy), holmium

(Ho), erbium (Er), a thulium (Tm), an ytterbium (Yb), and lutetium (Lu) are mentioned.
[0016]Before such a glass tube 11 dissolves the usual soda glass material, it adds the powder of the oxide of the above-mentioned element, and can produce it by dissolving and fabricating this mixture. The fluorescent substance layer 12 is a layer which the inner surface of the glass tube 11 was plastered with 3 wavelength-band luminescence type fluorescent substance, and was formed.
[0017]The range with preferred thickness of the glass tube 11 and thickness of the fluorescent substance layer 12 is explained later.
(an operation and an effect) Drawing 3 is a figure explaining the luminescence mechanism of the above-mentioned fluorescent lamp. In the fluorescent lamp of this embodiment, the main mechanisms which a luminescent light bunch produces are the same as that of the conventional fluorescent lamp. That is, if voltage is impressed to the electrode of the fluorescent tube 10 by the light circuit, discharge arises in the discharge space of fluorescent tube 10 inside, with the discharge, inside the fluorescent tube 10, mercury and rare gas will be excited and ultraviolet-rays UV1 (dominant wavelength of 254 nm) will occur. And if ultraviolet-rays UV1 generated is irradiated by the fluorescent substance layer 12, a fluorescent substance will be excited and the visible light V1 (wavelength of not less than about 400 nm) will occur. This visible light V1 penetrates the glass tube 11, is emitted outside, and serves as the main luminescent light bunches of the fluorescent tube 10.
[0018]In addition to this main luminescent light bunch, in the fluorescent lamp of this embodiment, a-like secondary luminescent light bunch (the visible light V2 and visible light V3) is also produced as follows. Although a part of ultraviolet-rays UV1 generated within the fluorescent tube 10 penetrates the fluorescent substance layer 12 and it is irradiated with it by the glass tube 11, Since the above-mentioned excited light ingredient is contained in the glass tube 11, near ultraviolet ray UV2 (wavelength is larger than 254 nm) and the visible light V2 are emitted from the glass tube 11 by exciting this excited light ingredient by the above-mentioned ultraviolet-rays UV1.
[0019]It is irradiated with a part of near ultraviolet ray UV2 emitted from the glass tube 11 by the fluorescent substance layer 12, the fluorescent substance of the fluorescent substance layer 12 is excited by this near ultraviolet ray UV2, and the visible light V3 is emitted. The above-mentioned excited light ingredient does not almost have the operation which absorbs visible light, either, and since it has melted into the glass which is the material of the glass tube 11 uniformly, it does not bar the penetration of visible light. Therefore, the visible light V1, V2, and V3 are penetrated without almost decreasing the glass tube 11, and they form the luminescent light bunch of a fluorescent lamp.
[0020]Thus, in the fluorescent lamp of this embodiment, since not only main luminescent light bunches (visible light V1) but the-like secondary luminescent light bunch (the visible light V2,

V3) resulting from the excited light ingredient contained in the glass tube 11 is produced, the part and luminous efficiency will improve. In the glass tube 11, since the excited light ingredient has melted into soda glass, compared with the case where it has melted into silica glass etc., the operation which is efficient and changes the ultraviolet radiation of the wavelength near 254 nm into the ultraviolet rays or visible light of long wavelength is done so.

[0021]When the concentration of the excited light ingredient contained in the glass tube 11 is too low, there are few amounts of excited light, and since ultraviolet rays will be absorbed by the self-absorption of an excited light ingredient if too high, it is preferred to set up luminous efficiency by within the limits suitable for making it high. The density range where an excited light ingredient is preferred changes somewhat with kinds of excited light ingredient, The case of the oxide of "the element belonging to 4A, 5A, and 6A fellows", and in the case of the oxide of "the element belonging to a lanthanoids", 0. The range more than 01wt% and not more than 10wt% is preferred, and, in the case of the oxide of "the element belonging to 3B, 4B, and 5B fellows", it is preferred to set up within the limits of more than 0.01wt% and less than 0.5wt%.

[0022]As shown by the experimental result mentioned later, the rate of a-like secondary luminescent light bunch (the visible light V2, V3) over a total luminescent light bunch (what doubled the visible light V1, V2, and V3) can be made into not less than 2% by making the glass tube 11 contain a proper quantity of excited light ingredients. By the way, the oxide of each element enumerated in the top has a peculiar emission spectrum, and conditions, such as availability, also differ.

[0023]For example, the emission spectrum of the oxide of the element belonging to a lanthanoids has many comparatively sharp light emission peaks, and the light emission peak position is also broadly distributed from the ultraviolet area to a visible range. On the other hand, the emission spectrum of the oxide of the element belonging to 3B, 4B, and 5B fellows has a broadcloth light emission peak over the range of 300-400 nm. Luminescence intensity of thallium oxide is strong also in it.

[0024]therefore, one sort of element oxides in which the above-mentioned element is suitable out of an oxide in consideration of those conditions when setting up the glass composition of a fluorescent tube -- or what is necessary is to choose two or more sorts and just to use as an excited light ingredient Thus, it has greatly advantageous flexibility that it can choose from the above-mentioned variety material as an excited light ingredient, when designing the glass composition in a fluorescent tube.

[0025]If it sees from the point of improvement in luminous efficiency in the oxide of the element enumerated as an excited light ingredient in the top, the oxide of the element belonging to a lanthanoids especially gadolinium (Gd), and a terbium (Tb) are promising. The fact that the oxide of these elements is suitable for the emission spectrum exciting efficiently the fluorescent substance generally used for a fluorescent lamp is cited as the reason.

[0026]That is, when irradiating the fluorescent substance layer of a fluorescent substance lamp with ultraviolet rays, the conversion efficiency to visible light changes with wavelength of the ultraviolet rays with which it irradiates. Here, the emission spectrum in the oxide of these elements has much light quantity in the wavelength range of 260-400 nm with ultraviolet ray conversion efficiency good to the common fluorescent substance for fluorescent substance lamps. Many [the light quantity in the wavelength area (near 550 nm) where the relative luminosity (Sensibility of the human eye) of people's eyes is high / comparatively] emission spectra of the oxide of these elements are mentioned as a reason high luminous efficiency is acquired.

[0027][Experiment 1]

[0028]

[Table 1]

試料NO.		1	2	3	4	5	6
組成	TIO	0	0.001	0.01	0.1	0.3	0.5
特性	初期光束値 (100h).1m	2300	2300	2350	2450	2480	2500
	光束維持率 (4000h).%	75.5	75.6	75	75.8	75.5	76

[0029]Sample No.1 shown in Table 1 is a compact fluorescent lamp concerning a comparative example, and sample No.2 - 6 are the compact fluorescent lamps concerning an example. Each of these fluorescent lamps is 145 mm in overall length, a glass tube diameter of 12.5 mm, and the rated voltage 32W. In the fluorescent lamp concerning an example, the basic material of the glass tube 11 is soda glass, and the presentation, SiO_2 -- 68wt% and aluminum$_2O_3$ -- 1.5wt% and Na_2O -- BaO of SrO is [K_2O / MgO / CaO / Li_2O] 1wt% 6wt% 5wt% 4.5wt% 5wt% 7wt% 5wt%. And TIO (thallium oxide) is added by this soda glass as an excited light ingredient. Here, the TIO concentration in the glass tube 11 is set up become each value (0.001wt% and 0.01wt% and 0.1wt% and 0.3wt% and 0.5wt%) shown in Table 1.

[0030]The fluorescent substance layer 12 is formed with the three-wave luminescence type fluorescent substance of the color temperature 5000K. On the other hand, the fluorescent lamp concerning a comparative example is the same composition as the fluorescent lamp of the above-mentioned example except for the point which has not added TIO to a glass tube. About each fluorescent lamp concerning such an example and a comparative example, the initial light flux value and the lumen maintenance factor were measured.

[0031]Measuring method: When an initial light flux value (100 h, lm) does life test for a fluorescent lamp for 100 hours, it is a value which measured light flux. When a lumen

maintenance factor does life test (the cycle of putting out the light for 15 minutes is repeated after switching on the light for 45 minutes.) for 4000 hours, it measures light flux, and it expresses the measured value concerned with the ratio to the above-mentioned initial light flux value.

[0032]A measurement result and consideration: Each measurement result is shown in Table 1. If each initial light flux value shown in Table 1 is compared, TIO in sample No.2 contained only 0.001wt%. although sample No.1 and the difference in which TIO is not contained are not seen -- TIO -- 0.01wt% - 0.5wt% -- compared with sample No.1, an initial light flux value is high not less than 2% at sample No.3-No.6 contained. On the other hand, about a lumen maintenance factor, a difference is hardly seen between sample No.1 - No.6.

[0033]The content of TIO in that an initial luminescent light bunch can be raised not less than 2%, without reducing luminescent light bunch maintenance and a glass tube is understood that it is preferred to use more than 0.01wt% by including optimum dose of excited light ingredients in a glass tube from this.

[Experiment 2] TIO content 0.3wt% of the soda glass used for sample No.5 concerning the above-mentioned example, and soda glass ****** used for sample No.1 concerning a comparative example and an emission spectrum when it irradiates with 254-nm ultraviolet radiation as follows were measured.

[0034]Measuring method : as the specimen of 2 mm in thickness and 20 one-side mm in length is produced and each soda glass is shown in drawing 4, The emission spectrum from the specimen 31 was measured with the instant spectroscope 33, irradiating with the 254-nm excitation light 32 to this specimen 31, so that it may become incident radiation intensity 0.4 mW/cm^2.

[0035]A measurement result and consideration drawing 5 are this measurement result, and, as for sign **, sign <> shows the measurement result about sample No.5 about sample No.1 among the figure. In the measurement result of drawing 5, by sample No.1 which does not contain TIO. as opposed to the field of long wavelength hardly showing luminescence from 254 nm -- TIO -- 0.3wt% -- emitting light on broad wavelength is accepted until sample No.5 contained reaches the light region near the wavelength of 450 nm with a peak of near the wavelength of 315 nm.

[0036]From this result, as above-mentioned drawing 3 explained, it is proved by irradiating with ultraviolet-rays UV1 with a peak of the wavelength of 254 nm the glass containing TIO that ultraviolet excitation light UV2 and the visible range excitation light V2 occur. In the above-mentioned experiments 1 and 2, although investigated about the case where TIO is added as an excited light ingredient, when investigated also about the case where the oxide of each element enumerated in the top is added, the same result as the above-mentioned experiments 1 and 2 was obtained.

[0037]When it investigates about the optimum density range of these each element, the case of the oxide of "the element belonging to 4A, 5A, and 6A fellows", and in the case of the oxide of "the element belonging to a lanthanoids", In the case of the oxide of "the element belonging to 3B, 4B, and 5B fellows", 0.01 - 0.5wt% of the range was suitable 0.01 - 10wt%.
[Experiment 3] the experiment about glass thickness, and a consideration excited light ingredient (TIO) -- 0.3wt% -- it was investigated with the thickness of the glass plate how the transmissivity of visible light would change about the soda glass board to contain.
[0038]Drawing 6 is a characteristic figure showing the result. It turns out that transmissivity is so higher than this figure that the thickness of a glass plate is small. TI0 -- 0.3wt% -- in the glass tube which consists of a glass material to contain, the path of the glass tube investigated how thickness would be changed fixed to constant value (12.5 mm), and relative luminescence intensity would change.
[0039]Drawing 7 is the characteristic figure created based on that result, O is a relative luminescence intensity actual measurement when the thickness of a glass tube is set as 1 mm, 2 mm, and 3 mm among a figure, and a curve shows the relation of the thickness of a glass tube and relative luminescence intensity which are guessed based on this actual measurement. In the range (the range of 1.5 mm or less) whose thickness of a glass tube is comparatively smaller than this figure, it turns out that relative luminescence intensity is so high that thickness is small.
[0040]Thus, with the glass tube which the excited light ingredient contained, if it takes into consideration that transmissivity and relative luminescence intensity become it high to set up thickness small, with the fluorescent lamp in this embodiment, it will be thought that it is advantageous to the direction which sets up the thickness of the glass tube 11 small raising relative luminescence intensity. Therefore, with the fluorescent lamp of this embodiment, although the glass tube with larger thickness than 0.62 mm is used for the arc tube in the common fluorescent lamp from the former, when raising luminescence intensity, it can say that it is advantageous to set the thickness of the glass tube 11 as 0.62 mm or less.
[0041][Experiment 4] the experiment about the thickness of a fluorescent substance layer, and a consideration excited light ingredient (TI0) -- 0.3wt% -- about the fluorescent lamp using the conventional common soda glass which does not contain the fluorescent lamp and luminescent components using the glass to contain. The thickness of the fluorescent substance layer was set as various values within the limits of 0-40 micrometers, and relative luminescence intensity was measured.
[0042]Drawing 8 is a characteristic figure in which showing the result and showing the relation between the thickness of a fluorescent substance layer, and relative luminescence intensity. If relative luminescence intensity compares the thickness of the fluorescent substance layer used as the highest in this drawing 8, When the soda glass containing TI0 is used to by the

way relative luminescence intensity serving as [whose fluorescent substance layer is not less than 20 micrometers when common soda glass is used] the highest, it turns out [whose fluorescent substance layer is less than 20 micrometers] that relative luminescence intensity becomes the highest by the way.

[0043]To it being advantageous that the thickness of a fluorescent substance layer shall be not less than 20 micrometers when raising luminescence intensity with a common fluorescent lamp from this result, with the fluorescent lamp of this embodiment, when raising luminescence intensity, it can say that it is advantageous that the thickness of a fluorescent substance layer shall be less than 20 micrometers.

[Embodiment 2] Drawing 9 is a sectional view of the arc tube of the fluorescent lamp concerning this embodiment.

[0044]Although the fluorescent lamp of this embodiment is the same as the fluorescent lamp of the above-mentioned Embodiment 1, the fluorescent tube 40 is used instead of the fluorescent tube 10. As for this fluorescent tube 40, the protective layer 43 intervenes between the fluorescent substance layer 42 and the glass tube 41. This protective layer 43 is a transparent layer which consists of material contained after it used as the base material the metallic oxide chosen from zinc oxide ZnO, titanium oxide TiO_2, oxidized silicon SiO_2, and aluminum oxide aluminum$_2O_3$ and the excited light ingredient had dissolved into the base material. The oxide of gadolinium (Gd) and a terbium (Tb) is promising also in the oxide of the element which is chosen from the oxide of the element (Ti, Zr--) quoted by the above-mentioned Embodiment 1 as an example of an excited light ingredient, and belongs to a lanthanoids especially.

[0045]About the fluorescent substance layer 42, it is the same as that of the fluorescent substance layer 12 of Embodiment 1. The excited light ingredient shall not contain in the glass tube 41. The protective layer 43 can be formed by the following methods. By adding to the powdered ingredient of the metallic oxide used as the base material of the protective layer 43, and fusing and grinding the powdered ingredient of an excited light ingredient to it, produce the powder of a multiple oxide and this powder with a dispersing agent. In addition to solvents, such as water or an organic solvent (isopropyl alcohol), coating liquid is produced by distributing this. And the protective layer 43 can be formed by using methods, such as an atomizing process, for the inner surface of the glass tube 41, applying this coating liquid, and drying and calcinating it.

[0046]Thus, by dissolving an excited light ingredient into a base material, the metallic oxide (ZnO, TiO_2, SiO_2, and aluminum$_2O_3$) of a base material and the metallic oxide of an excited light ingredient will form a multiple oxide. Using the sol gel process using the liquid which dissolved electrostatic spray painting or a metal alkoxide other than the above wet process in the organic solvent as a method of painting powder mixture to the inner surface of the glass

tube 41 is also considered.

[0047]By having the protective layer 43 which the excited light ingredient contained as mentioned above, both can be obtained as follows with the effect which raises the lumen maintenance factor by the base material in the protective layer 43, and the luminous efficiency improved effect by an excited light ingredient. Since it is hard to make the sodium diffused out of glass penetrate to the fluorescent substance layer 12, the base material in the protective layer 43 controls mercury reacting to sodium in glass and carrying out melanism by the fluorescent substance layer 12, and it does so the effect which raises a lumen maintenance factor by controlling degradation of a fluorescent substance. On the other hand, an excited light ingredient does a luminous efficiency improved effect so. This luminous efficiency improved effect is an effect that the luminescent light bunch which originates in the excited light ingredient contained not only in a luminescent light bunch but in the protective layer 43 based on the visible optical-pumping radiation by the fluorescent substance layer 42 by 254-nm ultraviolet rays like the above-mentioned Embodiment 1 arises, and that part and luminous efficiency improve.

[0048]That is, some ultraviolet rays generated with discharge within the fluorescent tube 40 penetrate the fluorescent substance layer 42, it is irradiated with it by the protective layer 43, and the excited light ingredient contained in this protective layer 43 is excited. Excitation radiation of a near ultraviolet ray and the visible light is carried out from the protective layer 43 by this, it is further irradiated with a part of near ultraviolet ray emitted from the protective layer 43 by the fluorescent substance layer 42 by it, and the fluorescent substance layer 42 carries out excitation radiation of the visible light by this near ultraviolet ray.

[0049]In the protective layer 43, since the excited light ingredient is dissolving into a base material, the visible light transmittance state of the protective layer 43 is not spoiled by the excited light ingredient. The operation to which excitation radiation of the above-mentioned near ultraviolet ray and visible light by an excited light ingredient is carried out, It is thought that it is obtained since an excited light ingredient dissolves into a base material and forms the multiple oxide as mentioned above, and such an operation is not obtained only by being mixed while the metallic oxide of a base material and the metallic oxides of an excited light ingredient have only been particles.

[0050]The range suitable as content of the excited light ingredient in the protective layer 43, By the above-mentioned Embodiment 1, it is the same with having been shown and the case of the oxide of "the element belonging to 4A, 5A, and 6A fellows", and in the case of the oxide of "the element belonging to a lanthanoids", In the case of the oxide of "the element belonging to 3B, 4B, and 5B fellows", 0.01 - 0.5wt% of the range is suitable 0.01 - 10wt%.

[0051]As thickness of the protective layer 43, 1-30 micrometers is suitable. Although the excited light ingredient is not contained in the glass tube 41 here, both the protective layer 43

and the glass tube 41 may be made to contain an excited light ingredient as a modification. Since material like TiO_2 does so both a penetration prevention operation of mercury and an excited light operation, if this is used independently, it will be thought that the same effect as this embodiment is done so, but. Of an independent ingredient, in addition to excited light becoming extremely small by a self-absorption, only the material of a ************ kind will be able to be used as a material of a protective layer, but the process of a protective layer will also be restricted. On the other hand, like this embodiment, if it uses combining a base material and an excited light ingredient, can suppress the self-absorption of excited light small, and. Since many combination of the kind of material which can be chosen as a base material, and the kind of material which can be chosen as an excited light ingredient exists, when designing the presentation of a protective layer, the range of choice of material becomes large, and the process of a protective layer is also advantageous at the point which can choose many things.

[0052]About the combination of the kind of base material, and the kind of excited light ingredient, it seems that it is preferred to use for this as an excited light ingredient combining both gadolinium oxide, and oxidation both [one side or], using oxidized silicon or an aluminum oxide as a base material.

[Embodiment 3] This embodiment explains the case where it applies to High intensity discharge lamp (HID), taking the case of a high pressure mercury fluorescent lamp, a metal halide lamp, and a high-pressure sodium lamp.

[0053]Drawing 10 is a figure showing an example of a high pressure mercury fluorescent lamp. This high pressure mercury fluorescent lamp is one sort of a high-pressure mercury lamp, and as shown in this figure, it comprises the arc tube 51, the cap 52, the outer tube 53, etc. The arc tube 51 is formed with transparent silica glass, both ends are equipped with the electrode 54, and mercury and argon gas are enclosed with the inside.

[0054]The fluorescent substance layer 56 is laminated on the inner surface of the glass tube 55 formed so that the arc tube 51 might be surrounded, and the outer tube 53 is constituted. And although visible light is emitted in the arc tube 51 by discharging in high-pressure (100 - 1000kPa) mercury vapour, in addition to this, with the arc tube 51, ultraviolet radiation is also emitted and the fluorescent substance layer 56 of the outer tube 53 carries out excitation radiation of the visible light in response to this ultraviolet radiation.

[0055]Here, the glass tube 55 of the outer tube 53 is formed with the borosilicated glass into which the excited light ingredient (Ti, Zr -- oxide of an element) same with having mentioned by the above-mentioned Embodiment 1 was made to melt. By this, the outer tube 53 concerned does so the same operation effect as the fluorescent tube 10 explained by drawing 3 of Embodiment 1. That is, although a part of ultraviolet radiation from the arc tube 51 penetrates the fluorescent substance layer 56 and it is irradiated by the glass tube 55, the excited light

ingredient contained in the glass tube 55 is excited by these ultraviolet rays, and emits the ultraviolet rays and visible light of long wavelength. And if the ultraviolet rays emitted from the glass tube 55 are irradiated by the fluorescent substance layer 56, excitation radiation of the visible light will be carried out.

[0056]The high pressure mercury fluorescent lamp of this embodiment can acquire the luminous efficiency outstanding compared with the case where the excited light ingredient is not added by the glass tube, by such operation. Although the outer tube 53 which consists of glass instead of the arc tube 51 which consists of quartz is made to contain an excited light ingredient on glass in this embodiment, this point also contributes to the improvement in luminous efficiency. That is, if glass is made to contain an excited light ingredient, compared with the case where silica glass is made to contain, it is comparatively efficient and the excitation ultraviolet radiation (peak wavelength of 254 nm) of mercury can be changed into the ultraviolet rays or visible light of long wavelength. Although ingredients, such as an aluminum oxide and boron oxide, are contained, these ingredients also have the work which controls the self-absorption of excited light in borosilicated glass by surrounding and isolating the circumference of an excited light ingredient in glass.

[0057]Although the high pressure mercury fluorescent lamp with which the fluorescent substance layer 56 was formed in the outer tube 53 was explained here, Also in the high-pressure mercury lamp with which the fluorescent substance layer is not provided in an outer tube, luminous efficiency can be raised to some extent by making the same excited light ingredient (Ti, Zr -- oxide of an element) as the above melt into the glass of an outer tube. That is, even when the fluorescent substance layer is not provided in an outer tube, an outer-tube excited light ingredient is excited by the ultraviolet rays from an arc tube, there is a operation effect of emitting visible light, and the luminous efficiency outstanding compared with the case where the excited light ingredient is not added by the glass tube can be acquired.

[0058]Next, a metal halide lamp and a high-pressure sodium lamp are explained, referring to drawing 11. Drawing 11 (a) is a figure showing an example of a metal halide lamp. Although the point that this metal halide lamp comprises the arc tube 61, the cap 62, the outer tube 63, etc. which consist of transparent silica glass is the same as that of the above-mentioned high pressure mercury fluorescent lamp, In the arc tube 61, besides the halogenation metal (for example, halogenide of a scandium (Sc) and sodium (Na)) as photogene, Mercury is enclosed as buffer gas for maintaining the arc discharge of rare gas and an electrical property, and the optimal temperature as an object for start up, and the fluorescent substance layer is not provided in the outer tube 63.

[0059]Here, this outer tube 63 is formed with the borosilicated glass in which the same excited light ingredient (Ti, Zr -- oxide of an element) as the above melted. In such a metal halide lamp, fundamentally, in connection with discharging within the arc tube 61, halogenation metal

dissociates to a metal atom and a halogen atom, and when a metal atom carries out excitation radiation of the visible light, a luminescent light bunch is obtained.

[0060]However, since ultraviolet radiation is also emitted with discharge in the arc tube 61, the excited light ingredient contained in the outer tube 63 carries out excitation radiation of the visible light by these ultraviolet rays. Therefore, compared with the case where the excited light ingredient is not added, a total luminescent light bunch increases by this operation. That is, the outstanding luminous efficiency is acquired. Drawing 11 (b) is a figure showing an example of a high-pressure sodium lamp.

[0061]This high-pressure sodium lamp comprises the arc tube 71, the cap 72, the outer tube 73, etc. And although appearance resembles the above-mentioned high pressure mercury fluorescent lamp, A polycrystal alumina-ceramics pipe is used for the arc tube 71, mercury as the xenon gas and buffer gas as start-up gas is enclosed with sodium as photogene in the arc tube 71, and the fluorescent substance layer is not provided in the outer tube 73.

[0062]Here, the above-mentioned outer tube 73 is formed with the soda glass with which the same excited light ingredient (Ti, Zr -- oxide of an element) as the above melted. In such a high-pressure sodium lamp, in connection with discharging in sodium vapor within the arc tube 71, excitation radiation of the visible light is carried out fundamentally, and a luminescent light bunch is obtained. However, from the arc tube 71, since ultraviolet radiation is also emitted a little, the excited light ingredient contained in the outer tube 73 is excited by these ultraviolet rays, and carries out excitation radiation of the visible light. By this operation, a total luminescent light bunch can acquire increase and the outstanding luminous efficiency compared with the case where the excited light ingredient is not added.

[0063][Embodiment 4] The case where this invention is applied to a filament lamp is explained. As a filament lamp, electric lamps for general lighting and a tungsten halogen lamp are typical. Electric lamps for general lighting are provided with the valve which consists of elastic soda glass or hard borosilicated glass, inactive gas (nitrogen, argon, krypton, etc.) is enclosed with the inside, and the electrode which consists of lead-in wire and a tungsten filament is provided.

[0064]In the tungsten halogen lamp, the valve which generally consists of quartz is used, a halogen substance is enclosed with this with inactive gas, and the electrode which consists of lead-in wire and a tungsten filament is provided. The excited light ingredient (Ti, Zr -- oxide of an element) same with having mentioned the filament lamp of this embodiment to the glass of the charge of valve materials by the above-mentioned Embodiment 1 in electric lamps for general lighting or a tungsten halogen lamp has melted.

[0065]Namely, in the case of a glass bulb, a valve is fabricated by being made from what added the excited light ingredient to the glass material, and, in the case of a quartz bulb, it fabricates a valve by being made from what added the excited light ingredient to SiO_2. Also in

the oxide of the above-mentioned element, especially the oxide of the element belonging to a lanthanoids is generally preferred as an excited light ingredient. This is because the light quantity in the wavelength area (near 550 nm) where the relative luminosity of people's eyes is high is comparatively large as the embodiment explained.

[0066]Although a filament serves as an elevated temperature, visible light is emitted and a luminescent light bunch is fundamentally obtained by energizing it to an electrode as usual in the filament lamp of such this embodiment, Since ultraviolet rays are also included a little in this synchrotron radiation, the excited light ingredient contained on the valve is excited by the ultraviolet rays concerned, and carries out excitation radiation of the visible light. And compared with the case where the excited light ingredient is not added, the increase of a total luminescent light bunch and the outstanding luminous efficiency are acquired by this visible luminous radiation. Such an effect is considered to be what has the larger one at the time of adding an excited light ingredient to a glass bulb than the case where an excited light ingredient is added to a quartz bulb.

[0067]

[Effect of the Invention]In [as explained above] the fluorescent lamp of this invention, When the ultraviolet radiation (peak wavelength of 254 nm) according the glass tube used for a fluorescent tube to excitation of mercury is received, the ultraviolet radiation of long wavelength is formed rather than the ultraviolet radiation concerned with the glass material which the excited light ingredient which carries out excitation radiation contained, Or in a fluorescent lamp provided with the fluorescent tube with which it was covered with the protective layer to which a glass tube inner surface uses a metallic oxide as a base material, and the fluorescent substance layer was covered on the protective layer, By making the excited light ingredient which carries out excitation radiation of the ultraviolet radiation of long wavelength rather than the ultraviolet radiation concerned when the ultraviolet radiation by excitation of mercury is received in a protective layer contain, The ultraviolet rays by excitation of mercury raised the utilization efficiency used for a luminescent light bunch, and the luminescent light bunch was raised not less than 2% compared with elegance conventionally in which an excited light ingredient is not contained.

[0068]By forming the ultraviolet radiation of long wavelength rather than the ultraviolet radiation concerned with the glass material which the excited light ingredient which carries out excitation radiation contained, when the ultraviolet radiation by the excitation radiation of the photogene enclosed with the arc tube in the outer tube is received in HID, The ultraviolet rays by excitation of mercury raised the utilization efficiency used for a luminescent light bunch. Also in the filament lamp, the synchrotron radiation by discharge raised the utilization efficiency used for a luminescent light bunch by making the valve of a filament lamp contain an excited light ingredient.

[Translation done.]